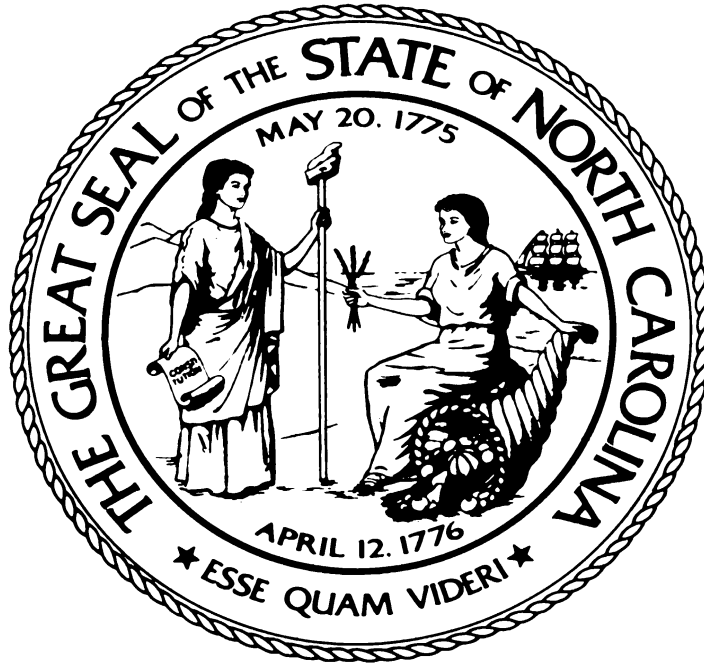


**STATE OF NORTH CAROLINA**  
**DEPARTMENT OF ADMINISTRATION**  
**STATE CONSTRUCTION OFFICE**



**FIRE SPRINKLER SYSTEMS**  
**GUIDELINES AND POLICIES**

**2011**

Revised June 22, 2011  
Effective July 1, 2011

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## APPLICABILITY

- A. The **FIRE SPRINKLER SYSTEMS GUIDELINES AND POLICIES** applies to all projects having design review and/or construction monitor responsibilities by the State Construction Office.

## PURPOSE

- A. The following guidelines and policies are established to aid the designer during design and specification writing. This document is not a design manual. The entire contents herein are not to be included in Designer's specification by reproduction, but shall be used as a guide only. The Designer can copy and paste applicable sections of the Guidelines and Policies to the project specifications. Variances of these guidelines and policies shall be discussed with the State Construction Office prior to submitting design to alleviate possible extra work on the designer's part.
- B. Use of any of this information will NOT reduce in any way the designers' professional responsibility for a complete performance design and fully functioning installation necessary to meet the State needs. It is the designers' responsibility to ensure all aspects of performance design, drawings, and specifications are complete and meet the NC Building Code and requirements of other regulatory agencies.
- C. The guidelines are periodically updated so latest information must be accessed before starting any project and before submitting material for review or approval. Information is dated at time of loading on the website so it may be easily checked to ensure current updates are being used.
- D. This document is organized in CSI's MasterFormat, and provides commentary on Fire Protection Systems provided for review to the State Construction Office. As such, there may be little or no commentary under sections which are routine or have not generated many questions in the past. Commentary is typically provided for Sections where:
1. State Construction design requirements are stricter than NFPA guidelines, i.e. requirement of minimum hazard classification as OH-1.
  2. State Construction formatting is recommended for consistency in order to aid the bidding and contract awarding processes, i.e. division of labor guidelines.
  3. State Construction design requirements limit materials due to field experience, i.e. flexible sprinkler heads require braided wire shield due to multiple field inspection failures with unshielded flexible sprinkler heads.
  4. Clarifications of NFPA or Code items that have generated numerous comments in the past that extended plan review acceptance times, i.e. flow tests not performed in accordance with NFPA standards.

## ADMINISTRATION

- A. Unless noted otherwise, ~~the edition of NFPA Code Edition 13, 14, 20, 22 and 24 as referenced in this document is the 2002 Edition of NFPA13, as this edition is referenced by the 2009 NC Building Code~~ is the minimum acceptable. A designer has the option of using newer versions of NFPA, subject to the following requirements:

1. The intent to use a newer edition must be submitted to the State Construction Office and approved at the Design Development (DD) stage.
  2. With few exceptions, a newer version of NFPA must be adopted in its entirety, and the project be designed consistently with the same NFPA Code Edition. For example, several citations in this guideline are from NFPA 13 2007 version. Where used it is because clarity was added by NFPA to the 2007 version for NFPA 13 2002 requirements.
- B. Unless specifically stated otherwise, the AHJ in this document is the State Construction Office (SCO).
1. The State Construction Office (SCO) is the Authority Having Jurisdiction (AHJ) for all State Properties, as defined in NC GS 425, 2009 session [1].
  2. Community Colleges over 20,000 SF for new or renovated spaces have The Department of Insurance as the AHJ, as defined in NC GS 58-31-40.
- C. The local fire code official or fire marshal referred to in this document is the Agency's Fire Protection Specialist and/or the local fire code official that will operate the fire apparatus. Although not the AHJ for State Properties, the technical input from these departments is required as noted within the document.

## BASIC REQUIREMENTS

- A. In every project, the Design Team is responsible for performance of the proposed system and shall insure that the designed equipment will integrate and operate satisfactory with resources available. When any of the existing building systems are expanded and new equipment added, the Design Team must verify utilities present and advise the Owner if the existing capacities will adequately support the proposed design without undermining the current facility performance or report if upgrading of existing infrastructure shall be necessary.
- B. Additions, alterations, repair, replacement, rehabilitation, or changes of occupancy shall be permitted to any existing structure or system without requiring the existing systems to comply with all the requirements of the current Building Codes. All new work shall conform to the requirements of the technical codes for new construction.
- C. For renovation projects:
1. Contract Documents shall address occupancy and facility use during construction process, specific requirements regarding phasing, restrains on schedules, restrictions on utilities disconnect, existing systems protection, and other constrains applicable for each and every discipline.
  2. When the building will be occupied during construction, the Design Team shall stress that all existing building safety systems such as exit signage, exit lights, fire alarm, fire sprinkler etc must remain operational CONTINUOUSLY in order to retain building occupancy status. All required exits and exit signs must be kept available and free of obstruction at all times. Follow the requirements of NCFPC 901.7 where required fire protection system is required to be out of service.

3. Specify dust and noise control during construction activities especially to protect occupied areas. Denote drawings regarding protection of existing ductwork system against contamination from dust and debris.
  4. Construction Documents shall address removal and/or abatement of Hazardous Materials (especially lead paint and asbestos) in accordance with approved and legal practice. Asbestos abatement must be conducted in accordance with the DOA guidelines <http://www.nc-sco.com/documents/guidelines/asbestos.pdf>
  5. If the asbestos removal and /or abatement are conducted by a separate contract outside of the Contract Documents, clearly denote that in the project. Provide 'warning note' that in the event suspicious materials are encountered, the contractor shall immediately cease the work in the area, secure the involved area to prevent inadvertent contamination or exposure and notify the Owner.
  6. Provide demolition plans for each discipline with clear indication of equipment and part of the system being removed. Identify any items that need to be salvaged and returned to the Owner. Specify any parts or materials that shall be recycled.
- D. Special attention is directed to NC General Statute 133-3 (**SPECIFICATIONS TO CARRY COMPETITIVE ITEMS; SUBSTITUTION OF MATERIALS**) for strict adherence thereto (for all equipment where available).
- E. Performance specifications shall be used. Where a manufacturer is listed on the drawings as the basis of design, two additional manufacturers capable of providing the product shall also be listed on the drawings.
- F. Observe NC General Statute 133-2 stating that drawings of plans and specifications by material furnishers are prohibited. It shall be unlawful for any architect, engineer, designer or draftsman, employed on county, State, or city works, to employ or allow any manufacturer, his representatives or agents, to write, plan, draw, or make specifications for such works or any part thereof.
- G. Fire Protection drawings and specifications shall be sealed by the design engineer of record registered in the State of North Carolina. If more than one professional seal is required for the specifications (such as if there are multiple disciplines), indicate the Divisions for which each professional is responsible. Seals shall appear on all submissions as a means of identifying the responsible engineer. Professional seals identifying the "author" and/or the "Designer of Record" shall be affixed to all drawings, specifications and other technical submissions. Construction documents shall include the name and address of the business entity (individual, corporation, or partnership) with whom the registered design professional is affiliated. Seals must be signed on documents submitted for Working Drawing/Construction Document (100% complete) review.
- H. Piping and head locations are NOT required to be part of the Construction Documents. Such layouts shall be denoted as being provided for general coordination and information only.
- I. The Specifying Engineer (PE) has primary responsibility for review and approval of fire suppression system shop drawings and hydraulic calculations. Specifying Engineer shall review and determine compliance with applicable codes and standards and the project contract documentation. After completing this review, the Engineer sends one (1) copy with a signed cover letter, including printed reviewer name, summarizing the outcome to the State Construction Office for approval:

For mail by US Postal Service:  
Assistant Director  
Design Review  
State Construction Office  
Mail Service Center 1307  
Raleigh, NC 27699-1307

For mail by UPS, FedEx, etc.  
Assistant Director  
Design Review  
State Construction Office  
301 N. Wilmington Street, Suite 450  
Raleigh, NC 27601

J. For all State Construction Reviewable projects with new or modified fire protection systems:

Shop drawings shall be submitted with format and content consistent with NFPA13 14.1 (2007 NFPA13 22.1.3). Shop drawings shall be accompanied with Hydraulic Calculation Forms, per NFPA13 14.3 (2007 NFPA13 22.3.2).

In the event of a renovation outside of the Remote Area, Designer shall identify the Remote Area and its location relative to the renovation area in order to speed the review process of the sprinkler system. If the remote area is not identified, a comment will be generated. Use of a key plan for this remote area identification is acceptable. The designer should be able to locate the remote area of an existing building on the drawings which are required to be attached to the sprinkler riser. Hydraulic calculations for a renovation need only be extended to the effective point of the water supply where the characteristics of the water supply are known, 2007 NFPA13 22.4.1.5.

In the event the renovations occur within the remote area, if five (5) or fewer heads are moved, shop drawings and hydraulic calculations will NOT be required to be submitted to SCO for review. If the renovations occur outside the remote area, and if ten (10) or fewer heads are moved, shop drawings and hydraulic calculations will NOT be required to be submitted to SCO for review. The Specifying Engineer may still require shop drawing submittal, review and approval.

This does not mean shop drawings or hydraulic calculations are not required to be performed, NFPA has no lower limit for this, however, if below the given thresholds, these documents will not be required to be submitted to SCO for review. The Specifying Engineer may still require shop drawing submittal, review and approval.

These hydraulic calculations are separate from the hydrostatic test requirements of NFPA13 16.2.1.5 (2007 NFPA13 24.2.1.4)—“Modifications affecting 20 or fewer sprinklers shall not require testing in excess of system working pressure.”

Cite the methodology used to amend the remote are, i.e. Quick-response sprinklers, dry pipe, room design method, etc.

- K. Installation drawings shall be prepared under the supervision of qualified “design professional” who can be a Professional Engineer (PE) registered in North Carolina or a minimum Level III technician certified in Fire Protection Engineering Technology and Automatic Sprinkler System Layout by the National Institute for Certifications in Engineering Technologies (NICET). Submittals, drawings, and hydraulic calculations shall bear the PE seal or NICET certification number and signature.
- L. Contractor License, Qualifications, and Responsibilities: The contractor must be licensed by the North Carolina State Board of Examiners of Plumbing, Heating, and Fire Sprinkler Contractors. Contact them at 919-875-3612 or <http://nclicensing.org/>. The contractor may be required to furnish evidence of satisfactory performance on previous sprinkler system installations of equivalent size, type, and complexity.

The contractor shall furnish all parts, materials, and labor required for a complete and operating system in accordance with all applicable requirements, even if each needed item is not specifically shown or described in the plans or specs. The contractor is also responsible for the inevitable adjustments in sprinkler head locations, sprinkler quantity, and piping required for full compliance with the NC Building Code, NFPA standards, and the project plans and specifications.

- M. The Building Code Summary shall be included on the first sheet of the plan set. In all buildings it is important to mark the correct sprinkler designation, because a complete, accurate review cannot be completed without the building's sprinkler status. Reference:  
[http://www.ncdoi.com/OSFM/Engineering/Documents/AppendixB\\_2009.doc](http://www.ncdoi.com/OSFM/Engineering/Documents/AppendixB_2009.doc).
- N. All drawings shall include a graphic scale. The graphic scale is required for reproductions that are not made to the correct sheet size.
- O. A complete Fire Protection symbol schedule and abbreviation legend shall appear on the first drawing sheet for each respective discipline.
- P. All floor plans and enlargements of floor plans shall bear North arrows, room names, room numbers, and column lines. All floor plans and enlargements shall have the same directional orientation. Site plans and floor plan directional orientation shall agree.
- Q. Indicate the location and rating of all fire/smoke rated walls on all plans, including shop drawings, using NCBC definitions of wall, barrier, or partition. Provide a legend for the symbols used. Fire and smoke ratings shall match the architectural design and be consistent throughout the project
- R. Provide current UL listed details of penetrations through rated assemblies on the contract documents and shop drawings. Include the UL design number.
- S. Fire-suppression equipment room layouts shall be arranged to provide access for removal, servicing, and maintenance of all equipment.
- T. Fire-suppression equipment room and fire pump room enlargements and sections (1/4"=1'-0" minimum) shall be provided.
- U. Fire-suppression equipment riser rooms and fire pump rooms should be placed at ground level and preferably away from occupied spaces to minimize transmission of vibrations and sound into the building.
- V. Fire-suppression equipment riser rooms and fire pump rooms shall be designed to have direct access from the outside.
- W. Text size used in drawings shall be 1/10" high (10 point) minimum. Plans are microfilmed for archival storage, and text smaller than 10-points becomes illegible when reproduced from microfilm.
- X. Written test reports and certificates as required by NFPA 13, 14, 20, 22 and 24 shall be provided to SCO prior making a request for final inspection and application for Occupancy Permit. Only NFPA system acceptance forms, no other forms will be considered.

## FIRE PROTECTION

### 21 00 00 Common Work Results for Fire-Suppression

- A. The Fire Protection Contract shall begin one foot above the finished floor inside the building and shall be delineated on the drawings. Reference NCGS 87-11 (b1).
- B. Fire protection systems shall be designed in accordance with the requirements of this guideline, National Fire Protection Association (NFPA), North Carolina Building Code (NCBC), North Carolina State Construction Office (SCO) and the local Authority Having Jurisdiction (AHJ).
- C. The Design Team shall solicit input from local fire officials or fire marshal when developing fire protection plans for State-owned facilities. Provide the State Construction Office with a copy of comments generated by the local fire officials. Where agencies have on-staff fire marshal's, their letter is required in addition to the fire official who will be operating the fire apparatus.
- D. Community college facilities are county-owned (State-assisted) and subject to inspection by local code enforcement officials. As such, fire protection plans for Community Colleges shall be reviewed and approved by local code and fire officials. Fire sprinkler requirements shall be coordinated with each College's fire insurer.

### **21 05 13 Common Motor Requirements For Fire-Suppression Equipment**

- A. This section delineates the division of work between Division 21 and Division 26 (Electrical).
- B. Specific work to be done under Division 26 is hereinafter listed or described. All other work necessary for the operation of Division 21 equipment shall be performed under Division 21.
- C. All individual motor starters and drives for fire protection equipment (pumps, etc.) shall be furnished and installed under Division 21 unless indicated as a part of a motor control center. Motor starters for fire protection equipment provided in motor control centers shall be furnished under Division 26.
- D. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter, or disconnect switch. Under Division 26 line side terminations shall be provided. Wiring from the termination point to the fire protection equipment, including final connections, shall be provided under Division 21.
- E. Equipment less than 110Volt, all relays, actuators, pressure, flow, pneumatic-electric, and electric-pneumatic switches, emergency break-glass stations, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 21 shall be furnished, installed and wired under Division 21.
- F. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 28 (Fire Alarm). All sprinkler flow and tamper switches shall be furnished and installed under Division 21, and wired under Division 28.
- G. Horsepower for all motors shall be indicated on the Division 21 and Division 26 Drawings.
- H. Where electrical wiring is required by trades other than covered by Division 26, specifications for that section shall refer to same wiring materials and methods as specified under Division 26. No Exceptions.
- I. A diagram clarifying who is to provide and install the termination point, such as (trough, ATS, individual starter, disconnect switch, JB, --- etc.) shall be placed on the electrical and the fire



protection plans. (Reference: <http://www.nc-sco.com/documents/guidelines/2008-GUIDELINES.pdf>). Refer to Appendix, page 64 of Electrical Guidelines.

- J. Conduits and wires specifications for other sections/divisions shall reference the wires and conduit specifications in section 26.

#### **21 05 48 Vibration and Seismic Controls for Fire-Suppression Piping and Equipment**

- A. Reference the building code summary for the facility seismic design category. A common omission for a renovation is the lack of a complete seismic design summary. This omission will result in a comment, because this information is required to accurately design and bid the sprinkler system. The NC Building Code determines when seismic bracing is required; NFPA 13 tells how it must be done when required.
- B. For seismic design categories A and B, the fire sprinkler drawings should state that "Hanging, bracing, and restraint of fire sprinkler piping shall be in accordance with chapter 9.1 and 9.2 of NFPA13.
- C. For seismic category C, the fire sprinkler drawings shall state that "Seismic requirements apply to this project. Hanging, bracing, and restraint of fire sprinkler piping shall be in accordance with section 9.3 of NFPA13. Shop drawings must signify approximate locations of all seismic bracing.
- D. For seismic category D (rare in North Carolina), additional seismic analysis is required which shall be by a professional qualified to perform seismic design in accordance with ASCE-7. Calculations and layout of restraints shall be submitted to this office for approval.
- E. Special Inspections as defined by NCBC 1704 shall not be required for the fire sprinkler system unless the system is located and designed in seismic category D.

#### **21 05 53 Identification for Fire-Suppression Piping and Equipment**

- A. All isolation and zone control valves and drain and test connection valves shall be provided with permanently marked weatherproof metal or rigid plastic identification signs.
- B. Indicate that all Fire-Suppression lines outside building footprint shall be required to have a warning tape installed in the backfill between 6 inches to 24 inches below finished grade, directly over piping. At a minimum, the following guidelines shall be followed. If an Agency has more restrictive guidelines, those Agency guidelines shall be followed.
1. Metallic lines shall be identified with printed durable plastic warning tapes, minimum 3" wide, with lettering to identify buried line below.
  2. Non-metallic pipes shall be identified by detectable warning tapes, minimum 2" wide, with lettering to identify buried lines below.

#### **21 08 00 Commissioning of Fire Suppression**

- A. Installation, Test, and Certification
1. Locating Valves, Drains, and Inspector's Test Connections

All sprinkler valves ~~and controls~~ must be located for safe and convenient access during emergencies and testing. Zone control valves shall not be located above ceilings.

2. Inspector's Test Connections should be operable from floor level. Where zone control valves must be located more than 7 feet AFF, per NFPA13 A.8.16.4.2 (2007 NFPA13 A.8.17.4.2), provision for access should be provided (e.g., permanent ladder/catwalk or, if the AHJ permits, a chain-operated valve).
3. Identify each valve ~~and control~~ with a prominent engraved phenolic or stamped metal placard. Any such devices that are behind access doors or panels must also have their location made known by an appropriate placard on the means of access.

#### B. Contractor's Material and Test Certificates

1. The contractor shall thoroughly inspect completed system to assure compliance with the engineer's plans and applicable Codes and Standards. IMPORTANT: This must include an operational test of each waterflow alarm switch and all system supervisory devices (valve tamper, hi-low air pressure, pump status, etc), in coordination with the fire alarm system contractor.
2. ~~Pressure~~ Hydrostatic tests shall be done with all sprinkler heads installed. Where an existing sprinkler system is being expanded or renovated, the contractor is responsible for the integrity of all new piping plus existing piping within three feet of new or renovation work, and the owner is responsible for the integrity of the balance of the system, during the pressure test.
  - a) Prior to final inspection by the AHJ and/or the owner's representative, the system installer is to submit NFPA-required Contractor's Material and Test Certificate(s) for aboveground, and underground, piping. Send copies to the following:
  - b) The Specifying Engineer (PE), if any
  - c) The Authority Having Jurisdiction (AHJ)
  - d) Representative of the Building Owner\*

NOTE: If the sprinkler contractor did not provide the underground piping, the responsible contractor must submit that certification. The sprinkler contractor is not to connect the riser until underground piping has been flushed, tested, and certified by the responsible contractor and witnessed by one of the above mentioned parties.

\*For State building projects, the owner is normally represented by the State Construction Office or by the facility's Construction Project Coordinator, as applicable. For private sector projects, the insurance carrier may be the "Representative of the Building Owner."

#### C. Reference Information

For convenient reference, relevant NFPA test requirements are summarized below. See the applicable NFPA standard for additional details and the forms that must be used by the contractor(s) to document the results of these tests.

1. Underground Pipe Flushing. Underground pipe shall be thoroughly flushed before being connected to sprinkler system. NFPA 24, Section 10.10.2 gives flow rates for flushing private service mains and lead-ins to sprinkler system risers. Use Table 9-1.1 flow rates and flush long enough to ensure thorough cleaning. (Certify flushing and hydrostatic testing together, per 21 08 00 C)
2. Underground Pipe Hydrostatic Test. Perform hydrostatic pressure test of the underground in accordance with NFPA 13 or 24 (generally 2 hours at 200psi), as applicable. The underground piping contractor must provide certification per 10.10.2.2.2 that leakage did not exceed limits described in detail by the relevant standard.
3. Interior Piping Test: For all new systems or modifications/expansions to existing systems affecting more than 20 sprinkler heads, hydrostatically test all interior piping and appurtenances in accordance with NFPA 13. This generally requires that the system hold 200psi for 2 hours without any water leakage. Record results and submit copies per 21 08 00 C, above.
4. Additional Air Test for Dry Pipe Systems. Pump the system to 40psi and allow it to stand for 24 hours. The air pressure must not leak down more than 1.5psi. Record results on the Contractor's Material and Test Certificate per 21 08 00 C, above.
5. Additional Operating Test for Dry Pipe Systems: All dry pipe systems must deliver sustained water flow to the inspector's test connection within sixty (60) seconds. Record the actual time on Contractor's Material and Test Certificate.
6. Fire/Booster Pump Acceptance Test (Performance Test): The fire pump must have a field acceptance test in accordance with NFPA 20-2003, Section 14.2. This test must include the pump manufacturer, the engine manufacturer (if provided), controller manufacturer, and transfer switch manufacturer (if provided). Also, 14.2.2 of NFPA 20 requires that the AHJ be given advance notice of the test date, time, and location. The Specifying Engineer may require a preliminary acceptance test prior to the final acceptance test.

D. System Documentation, Owner Training, and Spare Parts:

Documentation

1. The contractor shall supply the owner with two (2) copies of the required approved as-built shop drawings. Locations of all control valves and operating instructions shall be permanently mounted at the sprinkler riser or fire pump. See Appendix A for further requirements.
2. Training

The manufacturer's representative must instruct the owner's designated employees in operation of the system, and in all required periodic maintenance. A minimum of 2 hours on-site time will be allocated for this purpose and, for those facilities operating on a 24-hour basis (prisons, hospitals, etc.); one additional hour of instruction will be individually provided for the 2nd and 3rd shift. Two copies of a written, bound summary will be provided for future reference.

NOTE: Some facilities maintain their own systems and require more in-depth training. The designer must consult with the owning agency to determine specific training needs, including detailed installation and maintenance manuals, etc.

### 3. Spare Parts

The following spare parts should be provided with the system in addition to the required sprinklers.

- a) Special/Custom Escutcheons same as required sprinklers
- b) Special/Custom Cover plates same as required sprinklers

## 21 10 00 Water-Based Fire-Suppression Systems

- A. Area Increases. NCBC 506.3 allows area increase if “equipped throughout with an approved automatic sprinkler system in accordance with 903.3.1.1”. NCBC 903.3.1.1 (which is from the NCFPC 903.3.1.1), has only four exceptions which would allow an area increase without having a sprinkler throughout, and they are:
1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard.
  2. Any room or space where sprinklers are considered undesirable because of the nature of the contents, when approved by the fire code official.
  3. Generator and transformer rooms separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire-resistive rating of not less than 2 hrs.
  4. Rooms or areas that are of noncombustible construction with wholly noncombustible contents.
- B. Data Rooms. Please note that Data Rooms are NOT considered an exception under NCBC 903.3.1.1. It is however, a designer’s option to propose an alternate suppression system for a data room, in accordance with NCFPC Section 904, but, as stated in NCFPC 904.2, it is subject to the following stipulations:
1. Approval by the fire code official.
  2. Alternative automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed by other requirements of this code.
- Since an area increase or fire-resistance decreases will not be allowed if an alternative fire extinguishment system is designed, the designer is responsible for verifying an area increase is not required for the building being designed. Likewise, in the case where an existing building is being proposed for a retrofit, an alternative fire extinguishment system cannot replace a sprinkler system if area increases and fire-resistance ratings were required for the size of the existing building.
- C. Telecommunication Buildings. A sprinkler exception is granted under NCBC 903.2, but it is for exclusively telecommunications buildings, and then only in the areas where the equipment, associated electrical power distribution equipment and battery and standby engines are located, subject to the requirements in NCBC 903.2 Exception.
1. These telecommunications facilities are further defined in the NCBC Commentary, and essentially do not include data centers commonly designed in State Owned Buildings.

2. Meeting the NCBC 903.2 Exception does not automatically allow area increases, if required. The room or area under question is still subject to NCBC 903.3.1.1 evaluation to determine if an area increase could be granted without a sprinkler system.

## **21 10 10 Facility Fire-Suppression Water-Service Piping**

- A. Provide site plan showing fire water connection to main. Indicate location of the Back Flow Preventer (BFP), Post Indicator Valve (PIV), Fire Department Connection (FDC), fire pump test header (if applicable), exterior sprinkler alarm, and adjacent Fire Hydrants (FH).
  1. Shut off valves at BFP shall be provided with tamper switches for monitoring.
  2. At least one listed and properly supervised post indicating valve (PIV) shall be installed in source of the fire water supply. An indicating wall valve may be used when there is not a suitable location for a PIV.
  3. PIV shall be located 40 feet from building walls where space allows, unless other arrangements are made and approved by the local authorities.
  4. PIV shall include tamper switches or monitoring devices. A mechanical lock does not meet requirement of the NC Fire Prevention Code for code required supervision.
  - ~~5. FDC shall be located on the system side of the water supply alarm check valve.~~
  6. FDC shall be provided with listed check valve and no shutoff at connection piping to the system. The piping between the check valve and the outside hose coupling shall be equipped with an approved automatic ball drip valve.
  7. FDC shall be located within 100' of a fire hydrant.
  8. FDC shall be readily accessible and not located on loading docks or under a building overhang, behind fence or inside enclosed mechanical yard.
  9. FDC should be located not less than 18 in. and not more than 4 ft above the level of the adjacent grade or access level and, if yard type, shall be reinforced by a concrete pad at the ground penetration.
- B. BFP, PIV and FDC shall meet local AHJ standard and detail installation.
- C. Backflow Prevention Devices. Provide a cutoff valve on both sides of the backflow prevention device in the water supply connection, for isolation (servicing). Where a booster pump is installed, the backflow assembly, required by water quality regulations to be on the suction side, must be located as far from the pump intake as possible (at least 10 pipe diameters).
- D. Valve Types. An outside post indicator type control valve (PIV) must be provided for all systems. All indoor cutoff valves in the two (2) inch through eight (8) inch range shall be the butterfly type, with integral tamper switch and valve position indicator.

CAUTION: Butterfly valves bolted to a check valve frame may create an interference problem in some cases. Check specs to assure non-interference, or provide a short section of pipe between

them. Valves on each side of any fire pump are to be the OS&Y type. This does not apply to the fire pump bypass valves (kept normally open).

NOTE: We've had many field problems with frame-mounted tamper switches mounted on OS&Y valves using "J-bolts", often field-fabricated from threaded rod stock. Adjustment to obtain proper operation is often very difficult, and does not hold. Factory installed butterfly valve tamper switches have proven to be very reliable.

1. EXCEPTION (1): If approved by the AHJ, fire pump bypass valves may be either the butterfly or OS&Y type.
  2. EXCEPTION (2): If approved by the AHJ, All valves are permitted to be OS&Y type if their tamper switches are mounted with substantial, rigid frames (not "J-bolts"), so that adjustments hold.
- E. Fire Protection Main/Riser. Fire protection main piping should enter the building as close to the exterior as possible. The fire protection main piping should not be routed through the building. This would include but is not limited to running the fire protection main piping under the slab, through crawl spaces or above the ceiling. In the event that this is technically infeasible a water flow switch and control valve shall be installed where the fire protection main piping enters the building. Rooms or spaces containing the fire protection riser/fire pump should have direct access to the outside. Refer to the following NFPA citations:
1. 10.6.1 Pipe shall not be run under buildings. [24:10.6.1]
  2. 10.6.2 Where pipe must be run under buildings, special precautions must be taken, including the following:
    - (1) Arching the foundation walls over the pipe
    - (2) Running pipe in covered trenches
    - (3) Providing valves to isolate sections of pipe under buildings
  3. 10.6.4 Where adjacent structures or physical conditions make it impractical to locate risers immediately inside an exterior wall, such risers shall be permitted to be located as close as practical to exterior walls to minimize underground piping under the building. [24:10.6.4]

## **21 11 16 Facility Fire Hydrants**

### **A. Fire Hydrants:**

1. Reference 2009 NCFPC, Appendix C for minimum fire hydrant spacing requirements.
2. NFPA 24, Hydrants shall be located not less than 40 ft from the buildings to be protected
3. NFPA 24, the following shall not be installed in the service stub between a fire hydrant and private water supply piping:
  - a) Check valves

- b) Detector check valves
- c) Backflow prevention valves
- d) Other similar appurtenances

B. Tests:

1. ~~The fire sprinkler contractor shall repeat the hydrant flow test after the bid to aid in developing hydraulic calculations and shop drawings.~~
2. Fire main flushing and pressure testing shall be conducted in accordance with NFPA 24.
  - a) Flushing: Underground pipe shall be thoroughly flushed before being connected to sprinkler system in accordance with NFPA 24.
  - b) Hydrostatic Test is typically 200psig for two hours in accordance with NFPA 13 and 24. Provide certification per NFPA 24.

**21 12 00 Fire-Suppression Standpipes**

- A. When Required: NCFPC 905.3 sections 905.3.1 through 905.3.7 describe which buildings require standpipes, and the locations of the standpipes within those buildings are determined by NCFPC 905.4, 905.5, and 905.6.
1. In general, a Class III standpipe shall be installed throughout buildings where the floor level of the highest story is more than 30 ft (50 ft for Existing buildings NCFPC 905.11) above the lowest level of the fire department vehicle access, or where the floor level of the lowest story is located more than 30 feet below the highest level of fire department vehicle access. See NCFPC for exceptions.
  2. Stages. NCFPC 905.3.4 requires a class III wet standpipe on each side of stage if stage is greater than 1000 SF. See NCFPC for exceptions.
- B. Roofs. NCFPC 905.4(5) requires that each required standpipe be extended to the roof if there is no stair access and if the roof is less than 4:12 slope, or be extended to the highest stair landing if there is stairwell access to the roof and if the roof is less than 4:12 slope.
- C. Non-High Rise buildings. NFPA14 5.4.1.1 Class I standpipe systems shall be permitted to be any type described in NFPA14 Section 5.2 in buildings not classified as high-rise buildings. NFPA14 5.2, has a paragraph 5.2.5 that is a Manual Wet system, therefore it is allowed, and by its definition, it does not require the pressure in the system to be 100 psig UNTIL the fire apparatus is hooked up and pressurizes the system. Therefore a Manual Wet Standpipe is allowed in a non-high rise building. This may alleviate the need for a fire pump.
- D. High-rise NFPA14 5.4.1.2.1 In buildings classified as high-rise, all required standpipes shall be automatic or semiautomatic, including partial height and horizontal standpipes that serve only a portion or limited number of floors within the building. Therefore standpipes in a high-rise building are always required to be maintained at the required operating pressure without a fire apparatus connected.

- E. Existing High Rise Buildings. NCFPC section 9.5.11 allows manual standpipes in existing high rises if approved by the local Fire Marshal.

## 21 13 13 Wet-Pipe Sprinkler Systems

- A. Fire sprinkler system design shall be shown on fire protection plans, and not included on floor plans of other trades.
- B. Although fire sprinkler sizing and piping layout is allowed to be provided by the contractor in form of shop drawings, the Specifying Engineer is responsible for preparing criteria documents with "standard of care" which shall include design drawings containing sufficient information to indicate compliance with codes and to insure that the **installing contractor will not have to make design decisions**. Risers, zone control valves, and main drains shall be shown on the floor plan(s).

Plans and Specifications Content (Performance Design by the Specifying Engineer\*). This information defines the system's performance, major features, and acceptable materials. The following design details do not include pipe sizes, head locations, or hydraulic calculations. These are customarily done by the fire sprinkler system contractor, along with the hydraulic calculations that complete the system design. Plans shall include the following for a performance design:

1. Water supply test data (static pressure, residual pressure, flow, date and time of test) taken within one year. Identify the hydrants used, their elevation, and elevation of riser base.
  - a) Verification of adequate water flow and pressure test for a new or renovated sprinkler system.
    - (1) The water flow and pressure test is required during the design stage. It is in addition to the one required by the Contractor during the construction phase; the reason being the cost of an additional one during design is reasonable insurance against having to do a change order during construction to add a fire pump.
    - (2) Indicate the locations and elevations of the flow and pressure test hydrants on a site utility plan. Reference NFPA 13, 2002, section A.15.2.1 (NFPA 2007 A-23.2.1 and figure A-23.2.1) for the water test procedure. Please recognize the recommended flow test requires two hydrants, a pressure hydrant and a flow hydrant. One of the most common review comments occurs because only one hydrant is used. If plans are submitted with only one hydrant used for the test, a comment will be generated.
  - b) Designer must specify that the sprinkler contractor must verify the water supply by test, using 2 hydrants as close to the point of connection as possible, may be witnessed or performed by a fire official. Contact water authorities before test, to verify normal system status and to determine typical fluctuations in available pressure/flow at that location due to tank fill, pump status, industrial demand. Base design on 10psi less residual pressure and 10% less available flow than test results. Calculations start at water main connection under street and must include backflow preventer plus all valves and fittings. Use "1.4 Rule" and include hose stream allowance specified by NFPA 13 for that hazard.

Note: If, and only if, the flow test performed during the design phase is less than one year old by the date of the hydraulic calculations, and the test was fully compliant with NFPA 24, may the designer allow the contractor to use the original flow test and not perform another one.



Note: Please note that a “10% cushion for flow and pressure” is commonly cited, but this results in a comment, because if the available pressure is under 100 psig, a 10% pressure cushion is not as conservative as a 10 psig cushion.

2. Design density, remote area size, area per sprinkler, and hose demand
3. Permitted pipe, valves, sprinkler heads, fittings, and other materials
4. Backflow prevention device requirements, location, and installation detail
5. Fire/booster pump requirements and installation detail, when pump used
6. Sprinkler riser diagram, beginning where the sprinkler system contract does, showing all cutoff valves, test connections, supervisory switches, and drains.
7. Floor plans indicating the location of mains, standpipes, risers, control valves, test valves and drains. Illustrate the routing and discharge of main and auxiliary drain pipes.
8. Sprinkler seismic restraint requirements.

\* NC Statutes permit sprinkler contractors to do complete designs. Therefore, some projects may not have a specifying engineer. However, a design professional (PE) will generally be retained to do sprinkler projects in State-owned facilities. All technical requirements of this document apply, whether a PE is involved or not.

- C. Provide a fire sprinkler design summary table with, at the minimum, the following information for each fire sprinkler zone: system type (wet, dry, preaction, deluge), hazard classification, water application density, and hose allowance.
- D. Water Velocity. For water velocity limitations throughout the system refer to NFPA13 for hydraulically-calculated systems, (NFPA13 22.4.1.3 2007 Ver.). In general, NFPA 13 does not limit water velocities. However, limit sprinkler system water velocity in segments to the velocity allowed by the listing of any required devices, such as vane-type waterflow switches, to comply with its UL listing.
- E. Minimum Design Density. The hazard for each individual area shall be analyzed prior to determining sprinkler density, using NFPA 13-2002 Chapter 5 and A5.1 - A5.6. Ordinary Hazard Group 1 (defined by 5.3) is minimum system design normally accepted. Each protected area shall be analyzed independently to determine the greatest hazard present.

The minimum design density (–OH- 1) is 0.15gpm/ft<sup>2</sup> for the hydraulically most remote 1500 ft<sup>2</sup>. If there are open areas greater than 5,000 ft<sup>2</sup>, or if combustible construction is used, the minimum design density shall be modified in accordance with NFPA 13-2002, Figure 11.2.3.1.5. Use an operational area of 3000 ft<sup>2</sup>.

1. EXCEPTION (1): The OH-1 minimum shall not preclude the use of CPVC sprinkler pipe and fittings, although such pipe is listed for Light Hazard only. Provided that the entire occupancy is considered Light Hazard per NFPA 13 and the entire occupancy meets the listing requirements of the specified piping.

2. EXCEPTION (2): The OH-1 area/sprinkler limit (130SF) may be exceeded provided that the OH-1 density is still achieved.
  - a) NOTE: When QR sprinklers are used and open spaces are relatively limited in size (e.g., dorms, classroom-faculty office buildings), 11.2.3.2.3.1 of NFPA 13 is permitted to be used to reduce the system area of operation (and cost).
  - b) This is typically granted only for State-Owned Residences, ~~and~~ portions of Residence Halls and similar fire hazard occupancies.
3. EXCEPTION (3): QR or QREC heads, listed only for Light Hazard applications, may be used as long as OH-1 density is still achieved.
4. EXCEPTION (4): The use of Attic sprinklers (presently listed only for Light Hazard use) the minimum operating area design in such spaces shall be the greater of 2,000SF or 5 sprinklers for wet systems, and 2,600SF or 7 sprinklers for dry systems.
5. EXCEPTION (5): Combustible attic spaces without any provision for possible storage (access only for mechanical equipment and having no floored space that could reasonably be used for storage) are permitted to be designed for Light Hazard density. In some cases this may eliminate the need for a fire pump to achieve a higher system pressure at that elevation.

F. Miscellaneous Student Residence Halls, Dormitories and Apartment Sprinkler Requirements

1. Wardrobes
  - a) Portable wardrobe units do not require sprinklers to be installed inside them. Although the units may be fastened to the finished structure, they are considered by NFPA to be furniture rather than a part of the structure; thus sprinklers are not required. This was from a clarification provided in the 2007 Edition of NFPA13.
2. Closets
  - a) New Residence Halls, Dormitories and Apartments. If less than 12 SF, closets are not required to be sprinklered, unless such closet contains equipment such as washers, dryers, furnaces, or water heaters, then they shall be sprinklered regardless of size. NFPA 101 30:3.5.4.
  - b) Existing Residence Halls, Dormitories and Apartments. If less than 24 SF, closets are not required to be sprinklered, unless such closet contains equipment such as washers, dryers, furnaces, or water heaters, then they shall be sprinklered regardless of size. NFPA 101 29:3.5.5.
3. Bathrooms
  - a) New Residence Halls, Dormitories and Apartments. No exceptions for size
  - b) Existing Residence Halls, Dormitories and Apartments. If less than 55 SF, bathrooms are not required to be sprinklered. NFPA 13 21.20.18, 2007 version.

- G. System Zoning Requirements. Each story must be a separate sprinkler zone with a dedicated cutoff valve, tamper switch, water flow switch, and an Inspector's Test valve, typically referred to as a Floor Control Assembly, piped to a drain capable of handling full flow without backup or splatter. All Floor Control Assemblies, cutoff and test valves are to be located on the floor they serve, unless the AHJ permits a different arrangement.

NOTE: For buildings of more than 12 floors, consider two risers, separated from one another and located within stairways or otherwise protected from fire. Each riser would serve either: (1) Alternate floors, or (2) Roughly half of each floor. Where the floors are divided by smoke or fire barriers/partitions, we recommend option (2) if the sprinkler zone boundaries could reasonably correspond to smoke or fire barriers/partitions.

- H. Multiple Riser Designs. Multiple riser designs that require the operation of more than one floor cutoff valve to isolate any portion of the system are not permitted.

NOTE: This assures non-ambiguous waterflow alarm and enables a single valve to shut off water to any zone.

- I. Water motor-operated devices should be located as near as practicable to the alarm valve, dry pipe valve, or other waterflow detecting device. The total length of the pipe to these devices should not exceed 75 ft nor should the water motor-operated device be located over 20 ft above the alarm device or dry pipe valve.
- J. Per NC Fire Prevention Code, any sprinkler alarm, including water electric bell, shall be connected to and supervised by building fire alarm system.
- K. Per NFPA13 Chapter 8, electrical supervision per NFPA 72 is required for monitoring the position of all sprinkler cutoff valves beyond the water source valve, including the outside post indicator valve (PIV) and isolation valves for the backflow prevention device. Tamper switches for OS&Y valves shall be mounted to rigid frames secured by bolts through clamp bars. Coordinate with electrical design for monitoring the tamper switches by the Fire Alarm Panel. Show tamper switches and waterflow switches on electrical plans and fire alarm matrix.
- L. Electrical supervision per NFPA 72 is required for monitoring the position of all sprinkler cutoff valves beyond the water source valve, including the outside post indicator valve (PIV) and isolation valves for the backflow prevention device. Tamper switches for OS&Y valves shall be mounted to rigid frames secured by bolts through clamp bars. ("J"-hook mounting to the valve's frame is not permitted.)
1. EXCEPTION (1): If approved by the AHJ, Valves are permitted to be secured by locks when located in prison yards, underground pits, or other environments unsuitable for supervisory switches. The AHJ may permit additional exceptions based on the individual circumstances.
  2. EXCEPTION (2): If approved by the AHJ, normally closed valves to test headers, rooftop hose connections, etc., are permitted to be provided with locks, in lieu of electrical supervision.

Separate pump houses, unconditioned spaces containing wet pipe sprinkler systems and hot boxes shall include a temperature-sensing switch to monitor for low temperatures. A fire alarm system "supervisory" signal shall be initiated for temperatures of 40°F (5°C) or lower.

Dry pipe and pre-action system air supply must also be monitored, for both low and high pressure. Provide a "block and bleed" type ball valve to facilitate testing and adjustment of supervisory switches. A fire alarm supervisory signal shall be initiated for air pressure above maximum set point or below minimum set point.

NOTE: Low air pressure can cause a pipe dry system to trip wet, requiring it to be drained, then the dry pipe valve reset and repressurized. High air pressure will retard system response to fire, as the air pressure will first have to bleed down to the trip point before water enters the system.

- M. Per NFPA 13 Chapter 8, where aboveground water-filled supply pipes, risers, system risers, or feed mains pass through open areas, cold rooms, passageways, or other areas exposed to temperatures below 40°F, the pipe shall be protected against freezing by insulating coverings, frostproof casings, listed heat tracing systems, or other reliable means capable of maintaining a minimum temperature between 40°F and 120°F. Supervision is required for heat tracing.
- N. Specify that sprinkler heads be centered in ceiling tiles. Showing heads on floor plan is optional and may be left to contractors shop drawing submittal
- O. Sprinkler Heads
  - 1. For combustible attics, roof decks, or floors above crawl spaces, use sprinklers that provide good wetting of exposed combustible members. The acceptable options include listed attic sprinklers, or other special sprinklers.
  - 2. For dry pendant or sidewall sprinklers protecting refrigerated storage, see 21 13 16.
  - 3. Quick Response (QR) sprinkler heads shall be used in all sleeping rooms and laboratories, except where institutional heads are needed for security reasons. The use of QR heads is encouraged in any other applications for which listed. See the Exceptions under 21 13 13 for additional considerations regarding QR heads.
  - 4. Residential sprinklers are not to be used in dry systems, unless listed for dry system use, as water delay might permit too many of these more responsive heads to open.
- P. Sprinklers at draft stops and protection around large openings shall comply with NFPA 13 Chapter 8.
- Q. Address on plans sprinkler requirements at the exterior canopies, decks and any open spaces under the roof to comply with NFPA 13 Chapter 8.
- R. Stairs:
  - 1. Sprinklers shall be installed beneath each landing at all stairways of combustible construction
  - 2. In noncombustible stair shafts having noncombustible stairs with noncombustible or limited combustible finishes, sprinklers shall be installed at the top of the shaft and under the first landing above the bottom of the shaft.
  - 3. Sprinklers shall be installed beneath landings or stairways where the area beneath is used for storage.

4. Sprinklers shall be permitted to be omitted from exterior stair towers when the exterior walls of the stair tower are at least 50 percent open and when the stair tower is entirely of noncombustible construction.

S. Elevator Hoistways and Machine Rooms:

1. Sidewall spray sprinklers shall be installed at the bottom of each elevator hoistway not more than 2 ft above the floor of the pit.
2. ~~Sprinklers are not required for enclosed,~~ The sprinkler at the bottom of the elevator hoistway is not required for enclosed, noncombustible elevator shafts that do not contain combustible hydraulic fluids.
3. Automatic sprinklers in elevator machine rooms or at the tops of hoistways shall be of ordinary- or intermediate-temperature rating.
4. Upright, pendent, or sidewall spray sprinklers shall be installed at the top of elevator hoistways. (Sprinkler at the top of the elevator hoistway shall not be required where the hoistway for passenger elevators is min 1-hr rated noncombustible and the car enclosure materials meet the requirements of ASME A17.1, Safety Code for Elevators and Escalators).
5. Sprinklers in elevator machine rooms and sprinklers at the top of the elevator shaft (where installed) should include means to disconnect power to the elevator prior to water discharge. Acceptable means include:
  - a) Waterflow switch with no time delay.
  - b) Use of intermediate sprinklers along with a heat detector. The heat detector, with a lower actuation than the sprinkler head, actuates a shunt trip breaker to cut power to the elevator.

T. ~~Concealed Spaces: (note that per NFPA 13 space shall be considered concealed when occupancy or storage is not allowed, even such spaces may have small openings such as return air grill or a plenum).~~ Reference NFPA 13-2007, section 8.15.1.2, for concealed spaces not requiring sprinkler protection.

- ~~1. Noncombustible and limited combustible concealed spaces with no access and no storage shall not be required to be sprinklered.~~
- ~~2. Attics or crawl spaces where mechanical equipment requiring service is installed shall be sprinklered.~~

U. Sprinkler Piping. All Sprinkler system materials and components must be listed or approved, and installed in strict conformance to the conditions of their listing/approval.

1. Metal: Only steel pipe shall be used, with a Corrosion Resistance Ratio (CRR) of one (1) or greater. Schedule 5 pipe is not permitted. Schedule 10 steel pipe and the approximately equal "flow" products, sizes 1.5" and larger, are permitted to be used only with listed roll groove end fittings. All dry pipe, deluge, and pre-action system pipe must be galvanized, including any fittings exposed to weather.

- a) In all dry and preaction sprinkler system, internally galvanized pipe is required on State Owned Facilities, which exceeds the requirements of NFPA 13 Table 14.4.4.5 (2002 Version)
  2. Plastic: Listed, approved CPVC sprinkler pipe is permitted ONLY upon prior approval from State Construction Office for unusual circumstances.
- V. Fittings and Joints. All fittings must be listed or approved for the specific pipe and type of system they are used on. For gasketed fittings, install only with the lubricant the manufacturer obtained listing with, since other lubricants may not provide suitable performance. Note: Plain end, hooker, press-on, key-type, or slip-type fittings are not permitted. All grooved metal products on a job (including both fittings and couplings) must be products of the same manufacturer, as mixing different brands may result in leaks or failures due to variations in design dimensions or production tolerances.
1. Metal: The following joining methods are acceptable for steel pipe, to the extent permitted by listings, except that threading or cut groove fittings are accepted only for use on fully complying Schedule 40 and heavier pipe:
    - a) Threading
    - b) Shop Welding
    - c) Cut Groove with Gasket Fitting
    - d) Roll Groove with Gasket Fitting
    - e) Full Back Design Clamp-on Fittings
    - f) "U" Bolt Design Clamp-on Fittings (Only for pipe of 2.5" run size and smaller)
  2. Plastic: Listed, approved plastic pipe fittings are permitted ONLY upon prior approval from State Construction Office for unusual circumstances.
- W. Provide return bends for sprinkler connections, even with potable water connections. Deluge and dry sprinkler heads are excepted. Although NFPA 13 only requires return bends for water supplies connected to a raw water source, mill pond, or open top reservoir, experience with State Owned buildings has shown it to be less likely to gather sediment over time even with a potable water source, and taking the water from the top of the pipe allows greater flexibility for maintainability and flexibility with future renovations.
- X. Flexible Sprinkler Piping. Flexible piping is allowed only if the product meets the following minimum requirements.
- a) FM 1637 or UL 2443 listed flexible stainless steel hose with threaded end fittings.
  - b) Composition: 100% Type 304 Stainless Steel Hose.
  - c) ~~Fully welded non-mechanical fittings~~, Braided shield, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter

Strict manufacturers' installation instructions and limits shall be enforced. Flexible piping should be taken off from top of pipe, just like the hard-piped sprinkler heads and the requirements for return bends.

## **21 13 16 Dry-Pipe Sprinkler Systems**

### **A. Refrigerated Area Systems**

Dry systems for freezers must have a regenerative compressed air dryer that will maintain the system dew point at least 20°F below the lowest freezer operating temperature. For freezers with wet systems and dry pendant or dry sidewall heads, the connection between the sprinkler head and the wet pipe must extend at least 12 inches beyond the cooler and be provided with insulating wrap to prevent sweating.

#### **1. Special Construction Installations**

- a) Penetrations for sprinkler heads or sprinkler piping into special construction such as modular clean rooms, freezers, coolers or other spaces should be made by a manufacturer's representative to preserve the warranty and functionality of the space.
- b) Freeze Protection of Systems. Heat tracing is NOT acceptable for dry pipe or pre-action valve freeze protection. A heated room or closet must be provided to protect these vital components. For very small areas subject to freezing, antifreeze-primed sprinkler systems are permitted but not recommended. A glycerin solution is acceptable for either metal or plastic pipe and a propylene glycol mix is acceptable for metal pipe only. Ethylene glycol is not permitted to be used in any systems, due to environmental concerns.
- c) Sprinklers in walk-in type coolers and freezers with automatic defrost may require intermediate temperature heads, due to high temperature defrost cycles. See NFPA 13 8.3.2.5 (9), 2007 Handbook for explanation.

NOTE: Before using an antifreeze-primed system, first consider the alternatives such as dry sidewall heads for loading docks, etc. Avoid the use of antifreeze designs unless there is no reasonable alternative.

B. Steel pipe used in dry pipe systems shall be limited to internally galvanized steel.

C. To meet NFPA13 Chapter 11, 11.2.3.2.5, apply 30% area increase for dry pipe systems.

D. Per NFPA13 Chapter 7 Low Air Pressure Alarm shall be connected to Fire Alarm Panel or it shall be provided with pressure alarm annunciation device installed at constantly attended location.

## **~~21 13 19 Pre-action Systems~~**

~~A. The fire detection system used for pre-action valve control must comply with the latest issue of "Fire Detection and Alarm Systems," published by the NC Department of Insurance—Office of the State Fire Marshal/State Property Code Services Section. The required pre-action air pressures are: High Pressure Warning, 13-16psi NOMINAL AIR PRESSURE SETTING, 7-10psi Low Pressure Warning, 2-4psi~~

**21 13 39 Foam-Water Systems**

- A. Closed head foam-water systems shall be the pre-primed, wet pipe type, except use pre-action type if subject to freezing. (Dry pipe foam designs not permitted.) Design for solid performance at low flow rates. Endurance shall be at least 20 minutes full flow to the specified design area.
- B. Foam concentrates from different manufacturers are not to be mixed. Replace the concentrate used during system inspections ("top off" tank). Ceiling sprinklers are to be 286oF (141oC) rating. Provide a two-inch flushing connection at the far end of each cross main, with a conveniently accessible valve and piping to a suitable discharge location that permits the observation and sampling of foam.

NOTE: These flushing connections help assure a rich foam mixture upon initial flow, through pre-priming. They also facilitate needed periodic renewal of the water-concentrate solution in the system piping.

**21 20 00 Fire-Extinguishing Systems**

- A. All alternative suppression systems must be installed per their referenced standards. The uses of alternative suppression systems do not remove the requirements for required sprinkler systems. When an alternative suppression system is installed in areas without a required sprinkler system, a 100% capacity reserve should be connected to the system with automatic discharge upon receipt of a second alarm in the protected area.
- B. Please note the prohibited use of area increases and fire-resistance reductions discussed in Section 21 10 00 when Alternative Automatic Fire Extinguishing Systems are used in lieu of a required sprinkler system.

**21 30 00 Fire-Pumps**

- A. Determine in the early design stage, if a fire pump will be required for the fire protection system, as that greatly implicates design of, and coordination with other disciplines such floor plan layout, electrical system and emergency power, and construction cost.
- B. Fire/Booster Pump Installation, Water Supply, Throttling, Metering, and Control Horizontal split case and vertical split case pumps are adversely affected by elbows or T's mounted parallel to the plane of the pump. Such fittings are not permitted at the pump discharge, or within 10 pipe diameters of the suction side of the pump. There is no such restriction on elbows or T's perpendicular to the plane of split case pumps, and they also do not apply to vertical in-line pumps (typically < 750gpm).

The water supply to the sprinkler system must provide at least 150% of pump rated capacity at a positive pressure and also meet the system demand at 20psi minimum. The water supply test shall have been performed within the most recent 12 months, under normal system conditions. Consult water authorities in advance of testing to determine the anticipated range of tank fill, current pump status, and other variables such as unusual demand, to be sure the test results will be a valid (and conservative) basis for design.

NOTE: A water supply of 200% of pump capacity is recommended whenever this can be reasonably achieved.



NOTE: If the water supply will meet sprinkler system demand with a modest safety factor, and the pump is needed only to have a desired pressure at the top of the standpipe, see section 21 12 00 A.4 sections C. and E. for alternatives.

An automatic pilot-operated throttling valve must be installed, (as allowed by NFPA20 5.14.9) on the output side of the booster pump, to maintain required minimum pressure. Suction side control is not permitted, due to possible cavitation. Where permitted by the AHJ, a low pressure shutoff sensing the suction pressure may be substituted if the water supply provides 200% of pump rated capacity at a minimum pressure of 40psi, and an acceptable means is provided to periodically test the calibration of this device in its installed location. Where pump location makes flow testing from a header and play pipes impractical, provide a permanently installed meter for net pump performance testing without water streams. The meter outlet must discharge to a drain or to the suction tank, if provided, or (where permitted by the AHJ) to the suction side of the pump. A test header must still be provided for initial acceptance and other tests required by AHJ. Pump controller shall not be set to time-out pump run unless an automatic over-ride is provided to keep the pump running continuously in the event of water flow alarm.

C. Electric Fire/Booster Pump Power Sources: This section does not preclude the use of other types of pumps allowed by NFPA 20-2003, reference section E. Diesel Fuel Engine below. The ~~power~~ energy sources for electric fire or booster pumps shall comply with ~~Chapter 9 of~~ NFPA 20-2003. It requires a reliable design that minimizes the chance of power loss during a fire event or other emergency, thereby assuring that pumps perform their vital function under adverse conditions. Because hurricanes, ice storms, and floods have impacted normal utility power over wide areas for days (or even weeks), electric utility power does not have sufficient reliability to be used as the sole electric source for fire/booster pumps. Therefore, to comply with NFPA 20 criteria, the system design must include the following features:

1. A secondary source of electric fire pump power must be provided. Normally this will be a motor-generator set with capacity to carry the fire pump's locked rotor current plus the jockey pump and fire pump accessory equipment. The required KVA must be determined using data from the fire pump controller manufacturer. The M-G set manufacturer must certify the required output is achieved on each fuel the motor will use (e.g., a natural gas fueled motor having a propane tank for required on-site fuel).
2. The secondary power source must be separated from the normal power system and protected against interruption by fire attack, structural failure, operational accident, catastrophic failure of the main switchgear, etc.
3. Any disconnecting means for the electric feed shall be clearly identified, lockable, identified for use as service equipment, and separated from other disconnecting means such that inadvertent contemporaneous operation is unlikely.
4. Alternate arrangements to achieve power source reliability, such as feeds from two separate utilities (generally impractical), are subject to AHJ approval.

D. Fire Pump Room design shall comply with NFPA 20:

1. Indicate the size and location of any fire pumps required.
2. Indoor fire pump unit, in fully sprinklered building, shall be protected by min 1-hr rated enclosure, 2-hr in high rise.

3. Fire pump units located outdoors shall be located at least 50 ft away from any exposing building
4. Fire pump room shall comply with NFPA 20 regarding heating, ventilation and drainage. Temperature inside the fire pump room shall be maintained above 40F for protection against freezing and below 90F for protection against overheating of control elements.
5. The Fire Pump Room shall be equipped with emergency lighting per NFPA 101. All electrical components and wiring shall meet the minimum requirements of the applicable NFPA 70
6. Per NFPA13 Chapter 8 Fire Department Connections (FDC) shall not be connected on the suction side of fire pumps.
7. The fire pump system shall be designed to withstand an earthquake forces as required in NFPA 20 and NC Building Code Chapter 16
8. Provide an equipment schedule on the plans contract documents and shop drawings that indicate the following capacities and characteristics:

Rated Capacity:

Total Rated Head:

Motor Horsepower:

Electrical Characteristics:

Volts:

Phase:

Hertz:

Full-Load Amperes:

Minimum Circuit Ampacity:

Maximum Overcurrent Protection:

#### E. Diesel Fuel Engine:

1. The engine cooling system shall be included as part of the engine assembly and shall be in accordance with NFPA 20 Chapter 11.
2. If the radiator relies on mechanical ventilation, the power ventilator shall be connected to back up power.
3. Battery location and mounting shall comply with NFPA 20 Chapter 11.
4. Fuel supply tank(s) shall have a capacity at least equal to 1 gal per hp plus 5 percent volume for expansion and 5 percent volume for sump.
5. Diesel fuel supply tanks shall be located outside the building above ground in accordance with municipal or other ordinances and shall not be buried. Diesel fuel storage tanks can be located inside the pump room or pump house, if permitted by local regulations. Fill and vent lines in such case should be extended to outdoors. The fill pipe can be used for a gauging well where practical.
6. A guard, pipe protection, or approved double-walled pipe shall be provided for all exposed fuel lines

7. There shall be no shutoff valve in the fuel return line to the tank.
8. Where an electric solenoid valve is used to control the engine fuel supply, it shall be capable of manual mechanical operation or of being manually bypassed in the event of a control circuit failure.
9. Field Acceptance Tests:
  - a) The pump manufacturer, the engine manufacturer (when supplied), the controller manufacturer, and the transfer switch manufacturer (when supplied) or their factory-authorized representatives shall be present for the field acceptance test.
  - b) SCO and all the authorities having jurisdiction shall be notified as to the time and place of the field acceptance test

#### **21 34 00      Pressure-Maintenance Pumps (Jockey Pumps)**

- A. Indicate the size and location of any pressure-maintenance pumps required.
- B. Provide on the ~~plans~~ contract documents and shop drawings the following Capacities and Characteristics:

Rated Capacity:

Total Rated Head:

Motor Horsepower:

Electrical Characteristics:

Volts:

Phase:

Hertz:

Full-Load Amperes:

Minimum Circuit Ampacity:

Maximum Overcurrent Protection

# APPENDIX A

## SCO Fire Sprinkler System Acceptance Checklist

Installer's Sprinkler System Record of Material and Test Reports as required by:

NFPA 13-(Sprinkler Systems)	Date _____	N/A <input type="checkbox"/>
NFPA 14-(Standpipe and Hose Systems)	Date _____	N/A <input type="checkbox"/>
NFPA 20-(Centrifugal Fire Pumps)	Date _____	N/A <input type="checkbox"/>
NFPA 22-(Water Tanks for Private Fire Protection)	Date _____	N/A <input type="checkbox"/>
NFPA 24-(Private Fire Service Mains)	Date _____	N/A <input type="checkbox"/>
Backflow Preventer Certification	Date _____	N/A <input type="checkbox"/>
Other: _____	Date _____	N/A <input type="checkbox"/>
Other: _____	Date _____	N/A <input type="checkbox"/>
Other: _____	Date _____	N/A <input type="checkbox"/>

Designer's Inspection to Assure Fire Sprinkler Systems are constructed in accordance with contract documents:	Date _____	N/A <input type="checkbox"/>
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Please note that a copy of the following are required to be included in a PVC-tube container mounted to the wall adjacent to the sprinkler riser. Label the tube "Fire Sprinkler Shop Drawings".

1. Final Shop Drawings and Hydraulic Calculations
2. Acceptance Letter of the shop drawings from the Designer of Record
3. Approval Letter from the SCO

Please note a common acceptance deficiency is absent paperwork and paperwork that does not match the riser hydraulic plate data.

# APPENDIX B

## References

[1] GENERAL ASSEMBLY OF NORTH CAROLINA (exerpt)

SESSION 2009

SENATE BILL 425

RATIFIED BILL

The General Assembly of North Carolina enacts: .....

**SECTION 3.** G.S. 143-139(b) reads as rewritten:

"(b) General Building Regulations. – The Insurance Commissioner shall have general supervision, through the Division of Engineering of the Department of Insurance, of the administration and enforcement of all sections of the North Carolina State Building Code pertaining to plumbing, electrical systems, general building restrictions and regulations, heating and air conditioning, fire protection, and the construction of buildings generally, except those sections of the Code, the enforcement of which is specifically allocated to other agencies by subsections (c) ~~and (d)~~ through (e) below. The Insurance Commissioner, by means of the Division of Engineering, shall exercise his duties in the enforcement of the North Carolina State Building Code (including local building codes which have superseded the State Building Code in a particular political subdivision pursuant to G.S. 143-138(e)) in cooperation with local officials and local inspectors duly appointed by the governing body of any municipality or board of county commissioners pursuant to Part 5 of Article 19 of Chapter 160A of the General Statutes or Part 4 of Article 18 of Chapter 153A of the General Statutes, or any other applicable statutory authority."

**SECTION 4.** G.S. 143-139 is amended by adding a new subsection to read:

"(e) State Buildings. – With respect to State buildings, the Department of Administration shall have general supervision, through the Office of State Construction, of the administration and enforcement of all sections of the North Carolina State Building Code pertaining to plumbing, electrical systems, general building restrictions and regulations, heating and air conditioning, fire protection, and the construction of buildings generally, except those sections of the Code the enforcement of which is specifically allocated to other agencies by subsections (c) and (d) of this section, and shall also exercise all remedies as provided in subsection (b1) of this section. The Department of Administration shall be the only agency with the authority to seek remedies pursuant to this section with respect to State buildings. Except as provided herein, nothing in this subsection shall be construed to abrogate the authority of the Commissioner of Insurance under G.S. 58-31-40 or any other provision of law."